
Space Weather Technical Forecast

Issued on Thursday, 24 August 2023 at 01:22 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Ongoing chance of M-flares (R1-R2 Radio Blackouts). Chance G1 Minor Storm intervals during day 1 (24 Aug).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity is currently Low with the peak flare during the period a C3.9 flare peaking at 23/1407 UTC from AR3405 in the northwest disc. There are seven numbered sunspot regions on the disc, and one small unnumbered region. AR3415 (now Dac/Beta-Delta) is modestly sized, but remains likely the most complex region. However the analysis remains low confidence and it is possible that this apparent complexity is in some part due to foreshortening. AR3413 has seen some development of small spots to the north of its dominant leader. The other spots on the disc are smaller, simpler mature regions.

A filament eruption to the southeast was observed beginning around 23/2000 UTC, this is still under analysis. No other potentially Earth-directed CMEs were identified.

Solar Wind / Geomagnetic Activity: Solar wind speeds measured by ACE and DSCOVR at L1 persisted at slightly elevated levels, at around 400-450km/s. Density was near average but generally just below. Total Interplanetary Magnetic Field (IMF) Bt, was weak, generally below 5nT, with a slight rise between 23/1800-2400UTC to a peak of around 6nT. The north-south component, Bz, also weakly varying between -2 and 4nT, but predominately positive (northward). Phi angle was mainly negative (Towards the Sun). Geomagnetic activity was Quiet (Kp0-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at Background. GOES16 high energy (greater than 2MeV) electron flux was largely Moderate. The associated 24-hour fluence was well below the Active level, with an observed value of 1.24e7 integrated pfu at 24/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity is expected to be generally Low, but with a chance of isolated M-class flares.

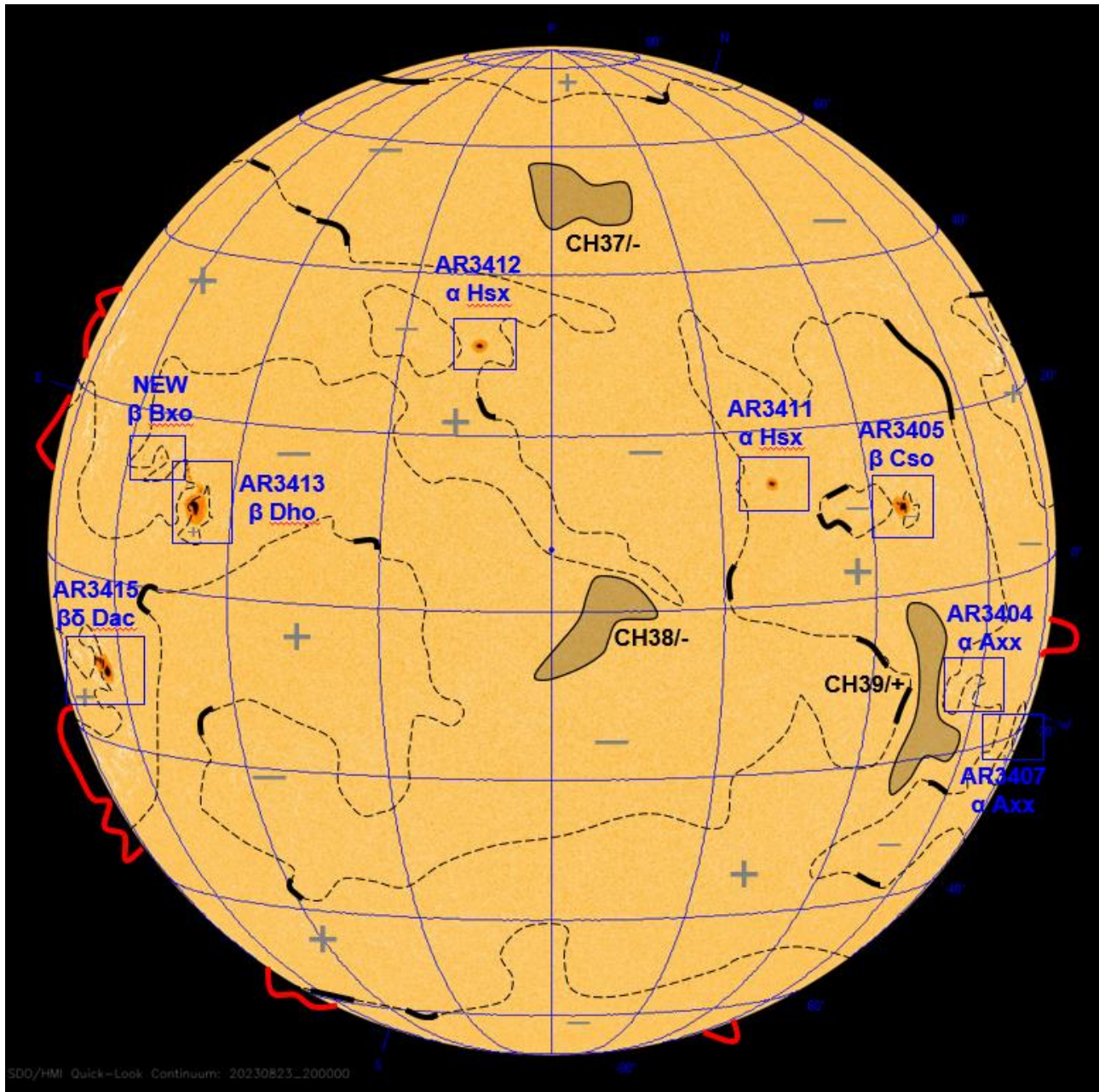
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently forecast. Current slightly elevated winds are likely to become enhanced during day 1 (24) due to the arrival of the fast wind associated with CH39/+, potentially rising to around 500-550km/s. Mainly Quiet geomagnetic activity is expected at first. This increasing to give likely Unsettled to Active intervals during day 1 (24 Aug), with a chance of isolated G1 Minor Storms. Activity is then expected to ease back to mostly Quiet to Unsettled day 2-3 (25-26 Aug). There is a slight chance of this rising again to Unsettled to Active from any further HSS arrival later day 3 into day 4 (26-27 Aug) most likely from CH38/-.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is

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expected to remain at Background levels. High energy electron flux (greater than 2MeV) currently Moderate. Any HSS solar wind enhancement both near term and into days 3 and 4 (26-27 Aug) is likely drop out observed flux to background, but an increasing likelihood of returning to Moderate, perhaps High levels into the period. The associated 24 hour fluence is expected to remain below the Active threshold ($1e8$ integrated pfu).

Figure 1. Solar Analysis Valid 23/2000 UTC.



Key: Filament —, Prominence —, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-γ-δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

There are currently no Earth-directed CMEs. A filament eruption from the 22 Aug is expected to pass just ahead, missing. A further filament eruption on 23 Aug from the southwest disc also expected to miss, with a filament eruption from a similar area 23/2000 UTC yet to be analysed awaiting imagery. The broad coronal dimming event from the M1.1 flare of AR3405 around 22/2300 UTC appears not to have produced an observable CME.

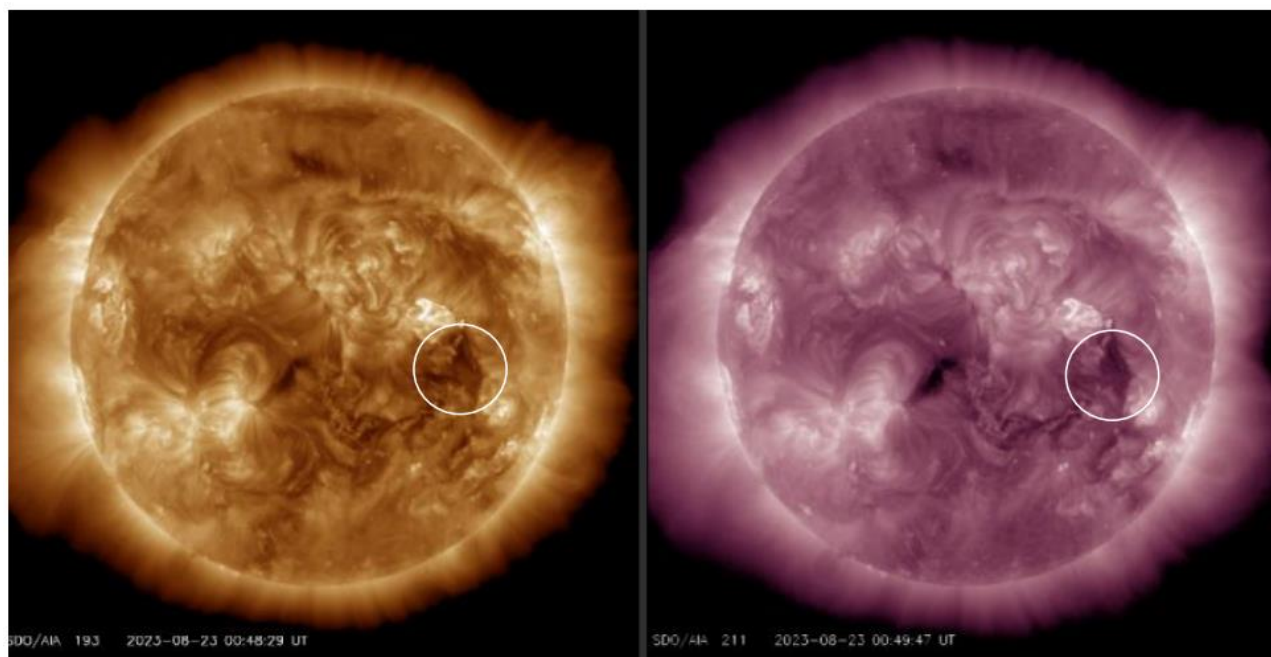
Solar winds remain slightly elevated, with the most likely source of any further increase in speed to be from any interaction with the fast wind of CH39/+ later possible during day 1 (23 Aug). This is a small positive coronal hole in the southwest disc, but due to nearby bright coronal the extent of this feature is uncertain in extent, although the dimming event above did enable a brief view of the likely hole. 27-day persistence is contaminated from a CME arrival, so despite the coronal hole being present on the previous rotation confidence is reduced. Furthermore, very little enhancement is indicated in current ENLIL modelling, however this failed to detect the recent fast wind enhancement and is not currently providing poor guidance due to this.

Overall, this gives low confidence in the forecast, however an enhancement to around 500-550 km/s is currently considered possible, most likely some time day 1 (24 Aug) before declining. Some further enhancement is also possible later day 3 (26 Aug) or more likely day 4 (27 Aug) due to the influence of CH38/- currently near centre disk.

Mainly Quiet geomagnetic activity is expected at first. This increasing to give likely Unsettled to Active intervals during day 1 (24 Aug), with a chance of isolated G1 Minor Storms. Activity is then expected to ease back to mostly Quiet to Unsettled day 2-3 (25-26 Aug). There is a slight chance of this rising again to Unsettled to Active from any further HSS arrival later day 3 into day 4 (26-27 Aug) most likely from CH38/-.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	25	5	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SDO aia-193 (left) and 211 (right) during CH dimming event associated with M1.1 flare 22/2304 UTC, allowing CH39/+ in SW to be more clearly observed (circled). CH38/- also visible near center disk.



Radio Blackouts - X-Ray Flares:

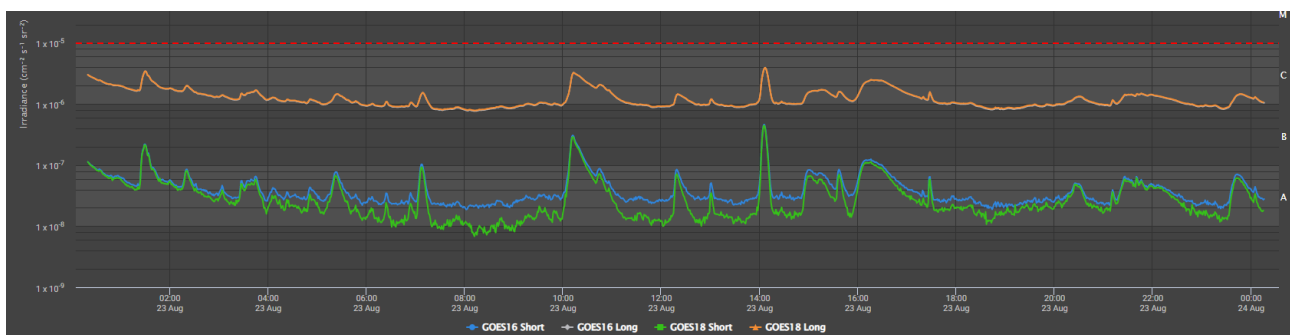
Activity is currently Low with the peak flare during the period a C3.9 flare peaking at 23/1407 UTC from AR3405 in the northwest disc.

The main sunspots of interest are AR3415 in the southeast and AR3413 in the east. AR3415 (now Dac/Beta-Delta) is modestly sized, but remains likely the most complex region. However the analysis is still lower confidence and it is possible that this apparent complexity is in some part due to foreshortening. A main negative polarity leader is currently accepted, including a strong umbra, closely followed by a likely positive trailer. These are then both encased within a single penumbra. The other spots on the disc are smaller, simpler mature regions. The exception is AR3413, which has continued to develop small opposite polarity spots to the north of its main dominant leader spot.

Low to Moderate activity is expected to continue with a chance of M-flares, primarily from AR3415, with a lower chance from elsewhere on the disc. Given the current assessment of AR3415, there is a slight chance of X-class flares, however this is low confidence due to uncertainties over the analysis and the lack of current notable activity.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: Last 24hr GOES-16/18 X-ray flux



Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at Background levels, with the spots on the western disc currently small and simple. A slight increase in risk from day 3 onwards (26-27 Aug) as the larger spots currently in the eastern disk continue to rotate.

Radiation Storms	Level ($\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq \text{S1}$	No	1	1	5	5
Very Active	$\geq \text{S3}$ *	No	1	1	1	1

* $\text{S3} \geq 10 \text{ MeV} \geq 1000 \text{ pfu}$ and / or $\geq 50 \text{ MeV} \geq 10 \text{ pfu}$. (pfu = $\text{cm}^{-2}\text{sr}^{-1}\text{s}^{-1}$)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy (greater than 2 MeV) electron flux observed by GOES-16 is currently Moderate. Any HSS solar wind enhancement both near term and into days 3 and 4 (26-27 Aug) is likely drop out observed flux to background, but an increasing likelihood of returning to Moderate, perhaps High levels into the period.

The associated 24 hour fluence is expected to persist below the Active level to start, with no significant enhancements expected. An increasing trend is expected day 2 (25 Aug) onwards, but with the risk of breaching the active level still low. MOSWOC REFM model currently looks to be providing reasonable guidance, pending the details of possible future HSS enhancement.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	5	5	10	15
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model output

